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Faculty of Economics and Administrative Sciences
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Master Thesis:

"Banks and Innovation: A Case Study of the Arab World"

"البنوك والإبداع: دراسة حالة للوطن العربي"

BY

Mais Nabel Hanna Jweinat

Supervisor:

Dr. Demeh Daradkah

Program: Finance & Banking Sciences

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Committee Members Decision

"Banks and Innovation: A Case Study of Arab World"

BY

Mais Nabel Hanna Jweinat

Bachelor Finance & Banking Sciences/Minor Accounting, Yarmouk University, Irbid , 2010

This thesis is submitted as a partial fulfillment of the requirements for the degree of Master in Finance and Banking Sciences, Yarmouk University, Irbid, Jordan.

Approved by:

Assistant Professor Demah Daradkah.......Chairman

Associate Professor of Finance and Bnaking, Yarmouk Univesrity.

Prof Mishiel Suwaidan.........Member

Professor of Accounting, YarmoukUnivesrity.

Prof Mohamad Ajlouni.........Member

Professor of Finance and Banking, Yarmouk Univesrity.

Date of Discussion

29/12/2014

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قرار أعضاء لجنة المناقشة

البنوك والإبداع : دراسة حالة الوطن العربي

إعداد

ميس نبيل حنا جوينات

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وافق عليها

د. ديمة درادكة .... مشرفاً رئيساً

أستاذ مساعد في العلوم المصرفية، جامعة اليرموك.

أ.د. ميشيل سويدان .... عضواً

أستاذ في المحاسبة، جامعة اليرموك.

أ.د. محمد العجلوني.. عضواً

أستاذ في العلوم المصرفية ، جامعة اليرموك.

٢٠١٤/١٢/٢٩

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Dedication

This work is dedicated to my parents, to my mum who never let me alone and always supported me in the difficult moments in my life, because she believe in my ability to succeed; to my Dad, the protector and founder of our home, who has done all the things to let me reach this stage of my life. I will never recompense his right. To my dear brothers Laith, Gaith and Kais who shared with me the moments of tiredness and studies, and for their love. To my friends and colleagues who gave me appreciation through their comments and negotiation, especially, Assel and Rand who shared with me all my moments in the university, in addition to Nada for her help. To my sister who never my mum give birth, Noha, for her real love and endless support; to the person who was the reason for my master for his encouragement; to each person wished me luck and prayed for me; I also would like to dedicated this work to the most special Dr. Demah Daradkah for all what she did to bring this thesis into the light, and to all doctors in the Yarmouk University who always stand beside me to teach me how to be a succeed person. At the end I have to dedicate this thesis to the family that I belong to "Jweinat".

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Abstract

Jweinat, Mais Nabeel. Banks and Innovation: A Case Study of Arab World, Master Thesis in Department of Banking and Finance, Yramouk University 2014, Supervisor: Dr. Demeh Ahmad Daradkah.

This study investigates the relationship between banks development and innovation at macro-level. Using a sample of (19) Arab countries over the period (1962-2012), from the World Bank. Innovation was measured by patent per capita per 1,000,000 person, banks development was measured by domestic credit to private sectors by banks as a percentage of the Gross Domestic Product. Economic growth, education and openness were added as a control variables.

The study finds that there is a positive relationship between banks development and innovation however significant at 10%. Also, a highly significant positive relationship between the education level and innovation, while other variables showed a positive relationship without effect on innovation level in the Arab World .

Finally the study recommends that banks in the Arab World should increase their role in financing innovation, which will be reflected in economic growth ratios, and focus more on enhancing education levels in their countries.

Keywords: Innovation, Patent, Banks Development, Economic Growth, Education, Openness, Arab World .

ملخص الدراسة

جوينات، ميس نبيل، البنوك والابداع: دراسة لحالة الوطن العربي، رسالة ماجستير، قسم العلوم المالية والمصرفية بجامعة اليرموك2014، إشراف: الدكتورة ديمة أحمد درادكة.

تهدف هذه الدراسة الى اختبار العلاقة بين تطور البنوك والإبداع على المستوى الكلي في الوطن العربي. وقد تم الحصول على البيانات من البنك الدولي لعينة تكونت من (19) دولة عربيه خلال الفترة (1962-2012). حيث تم قياس الإبداع ببراءة الاختراع لكل مليون فرد، أما تطور البنوك فقد تم قياسه بقيمة الائتمان المحلي للقطاع الخاص كنسبة من الناتج المحلي الإجمالي. كما تم إضافة التطور الاقتصادي و التعليم والانفتاح كمتغيرات ضابطة.

توصلت الدراسة إلى وجود علاقة ايجابية بين تطور البنوك والإبداع في الوطن العربي، كما توصلت الى وجود علاقة ايجابية ذات دلالة إحصائية بين مستويات التعليم والإبداع. بينما وجدت ان علاقة المتغيرات الأخرى ايجابية لكن ليس لها أي تأثير على الإبداع في الوطن العربي. وعليه أوصت الدراسة بضرورة التأكيد على دور البنوك في الوطن العربي في تمويل الإبداع والذي بدوره سينعكس على نسب النمو الاقتصادي في الوطن العربي، أيضا ضرورة التركيز على تحسين مستويات التعليم في تلك الدول.

الكلمات المفتاحية: تطور البنوك، براءة الاختراع، الإبداع، التطور الاقتصادي، التعليم، الانفتاح، العالم العربي.

Chapter One

General Framework

1.1 Introduction

Financial institutions brings together suppliers who have extra fund with demanders who need funds. Banks are considered one of the most important of those financial institutions. It is defined as financial intermediary deals with the monetary activities by accepting deposits, selling loans and performing agency services to their clients (Gitman *et al*., 2011, p51). In addition, it is perform other roles, such as attracting savings and direct them toward supporting the development projects and innovations in companies suffering from financial constraints. Innovation is defined as new products, services, ideas, technology process, and structure including their generations, adoption and implementation (Daft, 1978). The link between banks and innovation is scarcely covered in the literature. Schumpeter (1934) in his theory of economic development was the earliest one who investigated this relation. He emphasized that banking sector is a major element in financing process. Recent studies show a positive relation between innovation and different financing sources such as equity issues (Brown e*t al*., 2009), venture capital (Kortum and Lerner, 2000), bank credit (Nada and Necholase, 2011) and other sources. Levine (2005) indicated that countries with a well-developed banking sector grew faster

compared with those who had lagged financial systems. Recently, Benfratello *et al.,* (2008) and Ayyagari *et al*., (2007) used a microeconomitric modeling, find a positive effect of the development of banking on the rate of growth of small firms. This study contribute to the literature by taking a macroeconomic viewpoint and enable for estimation of aggregate effects, where macroeconomic condition influence companies capital structure choices. It is worth mentor that the bulk of studies related to this issue have been conducted in developed countries, where few studies covered the developing countries. Thus the current study will investigates the relationship between banking development and innovation theoretically and empirically in the Arab World based on previous studies.

1-2 Objectives of the Study

The main purpose of this study is to examine the relationship between banks development and innovation at macroeconomic level in the Arab World, where banks are considered a suitable source for financing, and major factor in facilitating and fostering the innovation process. The study attempt to provide evidence on this finance-innovation relation that have an effect on economic growth, based on that development of financial system especially banks which contribute in solving the financial constraint problem.

1-3 Importance of the Study

Innovation is a very essential topic to both academicians and practitioners. It was investigated across centuries by many researchers who realized its importance to the whole economy. This study stems its importance from the fact that most previous studies on banks and innovation subject has been conducted in developed countries, where this study covers this issue in the Arab World which its countries are consider developing countries. The researcher attempts to shed light on its multiaspects, due to banks important role in financing innovation process that improve the performance of businesses, increase their profitability and thus improve the state economy, and productivity growth**.** This study will benefit the companies who engage in innovation activities and the nations at the macroeconomic level.

1-4 Problems of the Study

Innovation has positive effect on both a firm's performance and the national economy. It is considered as a competitive advantage for firms in the long run, used as indicator of the firm's success, and its ability to change and develop the surrounding environment. Previous studies conducted in different countries show a strong relationship between banks development and innovation in different developed countries, so the research problem of this study can be expressed in the following question:

Is there a statistical significant relationship between banks development and innovation in the Arab World at the macroeconomic level?

1-5 Structure of the Study

This study contains six chapters. Beginning with chapter one that presents the general framework. The second chapter demonstrates the theoretical framework. The third chapter covers the literature review on banks development and innovation in addition to what distinguish this study from previous studies. The fourth chapter describes data, methodology, variables and their measurement in addition to the model used to examine the relation between these variables. The fifth chapter includes the estimation result and testing of hypothesis. The last chapter summarizes the study and presents the recommendations.

Chapter 2

Theoretical Framework

2-1 Introduction

This chapter presents innovation, definition and its important at micro and macro–level. Then it highlights the causal relationship between banks and innovation, clarifies the theories related to the subject, and finally present the Global innovation Index (GII) ranking for Arab World countries.

2-2 Innovation

Innovation took series attention in many disciplines such as economy, business, sciences and sociology due to globalization, economic and technological advancement (Johannessen *et al.*, 2001). It occupied a prominent place in the twentieth century, because lots of business and industries have more accelerating changing rate, more knowledge, competition, and changing in consumer needs (Daft, 2001, p17). It becomes a fashionable subject in developing countries, but it is often poorly understood and this results in conflict related to other concepts such as design, invention and creativity. Some writers use creativity as an synonym of innovation, but in realty there is a difference between the two concepts, where creativity is the building blocks for innovation and

thinking process that motivates employees to create a useful idea without development (Andriopoulos and Dawson, 2009). Creativity is requisite but not sufficient factor for innovation (Okipara, 2007), which occurs by adding something new to the existing product or process makes generation, implementation of knowledge and then bringing it to the commercial market (Schumpeter, 1934). In history it has been considered as a main characteristic of the firms and entrepreneur (Schmpter, 1934). Today firms are not aspired only to work effective business process, but also they need to understand and cope with changing of business conditions, besides to improve their ability to upgrade develop and implement a new ideas. The adaption of innovation becomes a vehicle for these firms to improve their performance under condition of scare resources, strong competition, complex business environment and changing customers demand (Jansen *et al*, 2006). At micro-level Individual companies welcome the innovative ideas and start serious taking steps toward implementation. At the macro-level innovation is one of the main factors for economic growth and increasing productivity (Solow, 1957).

2-3 Defining Innovation

Innovation is investigated in many disciplines and has been defined from many aspects and perspective (Damanpour and Schneider, 2006). It includes multiple types of change based on organization resources,

strategies, capabilities and requirements. Therefore takes the attention of practitioners and researchers for wide rang in business and management. Whilst it has many definition Zairi (1994) and Cooper (1998) showed that there is a lack of a common definition, which lead to undermines its accommodate nature. Innovation is predicted to be new to industry, market, organizations and environment in general, in order to distinguish it from the change related to application of new ideas, processes, or technology that is new to adopting organization (Daft, 2001). Schumpter (1934) one of the earliest economist defined innovation as new elements or new combination of existing elements in industrial organization that creates growth in economy. Also Schumpter (1947) thought of innovation as the ability to create new value, suggestion through introducing new product, services, adapting a new operating practices, and creating new competencies and skills. According to Urabe *et al*., (1998, p.20) innovation can be defined as the generation of new ideas and its implementation into products, processes, and services, leading to the dynamic growth of national economy and creation of pure benefit to the companies that innovate. Amabile *et al.,* (1996) provides a brief definition to innovation include "successful implementation of creative idea inside the organization". Porter (1996) and Harrison and Huntingtion (2000) added that innovation leads to solution to problems that could have an effect on firms revenues, effectiveness of industry sectors and the whole nation.

Kuczmarksi (1998, p44) defined it as "invention plus application". Damanpour and Goplakrishnan (2001, p45) also, defined innovation as "the inclusion of behavior and ideas related to a service, product, system, device or program that is new to adapting companies and managers perceives to be true". Based on Grossman and Stiglitz (1980) and Merton (1987) innovation is defined as the channel through which better access to finance affecting growth, and the extent to which organizations are successful in yielding innovation output.

2-4 Importance of Innovation

Usually referred to the availability of the appropriate culture to encourage innovation in organizations as one of the basic characteristic for distinctive foundation, innovation has multiple importance at the micro and macro- levels:

At Micro- level:

1- Innovation is one of the main elements that influence the firms and organization success (Nonaka, 1991) .
2- Innovation enhances performance and profits (Crepon and Lung 1999).

3- Innovation achieves competitiveness through developing technology and upgrade firms activates and process (Hitt *et al.,* 1991).

4- Innovation provides more valuable goods to meet customer demand (Berzkalne and Zelgalve, 2011).

At Macro- level:

1- Innovation is an engine of productivity factor and long- term economic growth (Romer, 1994).

2- Its create knowledge that enable other firms to take advantages and benefit from the initial innovation, which in turns benefit the whole society (Romer, 1994).

3- It's one of the main driver for raising wealth and national income (Aghion and Howitt, 1992).

4- offer full employment and positive balance of payment from international tread (Aghion and Howitt, 1992).

2-5 Financial System Development and Innovation

Financial development include expansion of institutions, instruments and markets that back innovation and growth processes. Their role extended from pension funds to stock markets (Fitzgerald, 2007). Banks represent a main component of this system and important source in

financing innovation through bringing together suppliers of fund with demanders of funds (Gitman *et al*., 2011). The development of banks impacts selection, mentoring of investment project, effectiveness of internal inputs, funding research and development expenditure, decreasing cost of acquiring information and relaxing financial constraint (Benfratell *et al*., 2008).

The relation between banks and innovation has preoccupied economists who argued that developed financial system is basic to encourage innovation (Schumpeter, 1934). This is consistence with Herrera and Mintti (2007) indicated that companies with longer borrowing relationships innovate more. Benfratelletal *et al.,* (2008) also, suggested that more bank branch density as indicator of banks development goes hand-in-hand with more companies innovation. Change in the local banking nature changes innovation due to the improvement in access to credit.

At the macro–level, banks play an important role in accelerating growth at certain stage of economic development (Levine, 2005). Tadesse (2005) showed that countries with a well-developed banking sector, due to technological innovation, achieve higher rate of productivity. These technological advancements lead to making huge external capital at lower cost, which decrease the cost of doing business. In general, banks

development are of interest to those companies which are in sectors that have higher dependent on external finance, by enable them to introduce more new products, processes and operate close to technological frontier (Rajan and Zingales, 1998).

2-6 Innovation Theories:

2-6-1 Diffusion of Innovation Theory

Innovation is a tool to each one seeking profits and it's an essential engine of competitiveness, productivity and economic growth, considering it the center of economic change. Schumpter (1934) divided innovation into four dimensions: invention, innovation, diffusion and imitation. Invention started in the fourteenth century as finding or discovery, then apply to new created things.

Innovation represents the core renewal process in all firms. Its tightly related to change their environment (Dampanpour, 1991). Diffusion and imitation process have the greatest impact on the state of economy (Schumpter, 1934) and the society at large will not benefit without diffusion. Earlier Gabriel Trade in (1903) in his theory diffusion of innovation plotted the original S-shape rate of adaption and according to the steepness of this shape he determined that rate which consider a numerical indicator of individuals who adapt a new idea in a specified period. Rogres (1995) defined diffusion as "the process by which an

innovation is communicated through certain channels over time among members of social system, where communication is the process through which innovators create and exchange information with others". The OECD (1992) also defined diffusion as " the way in which innovation spread through markets and non-markets channels". Large companies influence this process by affecting their consumer responses through advertising and sales promotion. The rate of diffusion differs among products according to the enhancement that the user takes from innovation, and the reduction in cost that the adapter gain.

The innovated enterprise are not the only beneficiary from their innovation. The diffusion process enabling imitators also achieved profit when they begins invest in that innovation. Therefore if diffusion process take place across time it will leads to publish new techniques, product and service that may allowing full benefit to the economy (Rogres, 1995).

2-6-2 Endogenous Growth Theory (EGT)

Factor accumulation and innovation both matters for long–run growth, EGT explains that growth represented by economic activities, leads to create technological knowledge needed for technological progress. It is one of mainstream economics approaches to modeling that growth, which mainly result from endogenous and internal process, not external forces. This theory emphasized that the enhancement and investment in human

capital, innovation and knowledge, leads to more efficient and effective technology that raises the growth. It depends on policy measures such as subsidies, education, research and development, competition and intellectual property (Aghion and Howitt, 1998).

EGT model assumes the ability to capture some benefits from ideas that are converted into innovation through patent and intellectual property right, makes more incentive to invest time and energy in innovation (Maré, 2004). Economic factors and policies have an impact on rate of innovation by influence the cost and benefits of doing these research and development (Romer, 1994) .

2-7 How to Measure Innovation?

New knowledge leads to innovation. To understand that role, it should be a new way to measure knowledge inputs and knowledge outputs. Innovation is a complex process and it difficult to measure, (Acs *et al*., 2002). Empirical research used different indicators for innovation such as:

1-Research and Development Expenditures: are the most common indicator, it an input measurement that might leads to output, measures the allocated resources for producing innovative activity and refers to the degree to which organization has ability to introduce new products, processes or new device to the market (Freeman and Soete, 1997). Weaknesses of this indicator represented in its inability to introduce

information about output of the innovation process (Klinknech *et al*., 2002), and has a limited usage in the developing countries as a result of rarely research and development departments (Aghion *et al*., 2004). Researchers such as Hsu (2011) uses research and development expenditures to total sales in order to measure innovation at firms level, while Mehmood (2013) uses it as a portion of GDP to measure the overall innovation process at macroeconomic level.

2-Patents: They have been long used as indicators of innovation process output at both micro- and macro-levels(Pakes and Grilliches, 1980). Acs and Audrelsch (1989) provide evidence that patents could be a fairly reliable indicator of innovative efforts at the industry level. It's one of the most suitable indictor, allowing researchers to capture the innovative performance in different terms. Lachenmaier and Rottmann (2011) explain that due to the high cost correlated with patents applications, this indicator adequately capture the high return. Shortcomings of patent represented by that, parts of them will never be converted into commercially product or process, where some of them could be hidden by strategic behavior in order to prevent competitors from their uses (Kleinknecht *et al*., 2002). Griliches (1998) also indicate that patents are defective measure, where not all innovations are patent and they greatly differs in their influence on economic.

3-Trademark: It is a potential new indicator of product innovation, It is importance lies in differentiate the quality of goods and services in the market place and took lot of interest as a sources of quantitative and qualitative information on economic activity (Andrews and Serres, 2012). Trademark as an indicator of innovation as a whole have a strength relative to the availability of data in the balance sheet and covers large kinds of innovation input and output, but it suffers from weaknesses where they are based on accounting data that could be incorrect or determined according to many accounting standards (Feeny and Rogres, 2001).

In conclusion R&D could be an acceptable indicator of innovative activity, patents could be more than reasonable indicator of innovation output, while trademark provide new reliable indicators of innovation.

2-8 Innovation in The Arab World:

2-8-1 Global Innovation Index (GII)

This section includes definition for the Global Innovation Index and the way its measured, then review for the Arab World countries and their ranking according to this index during (2007-2014).

The global Innovation Index (GII) is an indicator that ranks countries economics in terms of their enabling environment to innovative and their innovation output. It is a report established as a leading reference on

innovation for researchers, public and private decision makers. It is measured by seven factors including research and development intensity, high technological density, researcher concentration, manufacturing capability, tertiary efficiency and patent activity, beside indicators that go beyond the traditional measures of innovation. GII adopts an inclusive horizontal vision of innovation applicable to both developed and emerging economic, published by a collaboration between Cornell University, INSEAD and the World Intellectual Property Organization (WIDO) a co-publishers. Shows a picture of countries strength and weaknesses with respect to innovation related policies and practices, using a model relies upon eight pillars made up of five inputs and three outputs, that enhance innovative capacity. Pillars include institutions and policies, human capacity, infrastructure, technological sophistication, business market and capital, knowledge, competitiveness and wealth. Over time, the GII has become an effective framework for evaluating innovation performance, and ranking between nations across the globe (INSAD Report, 2013).

The following table will review the ranking of the Arab World countries from (2007-2014) according to this reports:

Table (2-1)

Global Ranking of Arab Countries by INSEAD:

country	Rank 2007	Rank 2008-2009	Rank 2009-2010	Rank 2011	Rank 2012	Rank 2013	Rank 2014
UAE	-	26	-	-	37	38	36
Saudi Arabia	-	32	54	54	48	42	38
Qatar	-	24	35	26	33	43	47
Bahrain	-	34	40	46	41	67	62
Jordan	**53**	**55**	**58**	**41**	**56**	**61**	**64**
Kuwait	30	30	33	52	55	50	69
Oman	-	52	65	57	47	80	75
Lebanon	-	-	-	49	61	75	77
Tunisia	41	46	62	66	59	70	78
Morocco	76	82	94	94	88	92	84
Egypt	74	76	74	87	103	108	99
Algeria	83	108	121	125	124	138	133
Yemen	-	-	-	123	139	142	141
Sudan	-	-	-	124	141	141	143
Syria	-	94	132	115	132	-	-
Libya	-	119	109	-	-	-	-
Total countries ranked	107	130	132	125	141	142	143

Sources: INSEAD Report

GII started published annually since 2007, as an index of innovation, used to rank the world countries and now it is in its seventh edition. The Arab World countries are included in this index and ranked with other world countries according to the indictors that is taking into consideration by the index. Given the above table (2-1) it is shown that across years from 2007 to 2014, some countries occupied advanced ranked while other countries slipped down the rankings. In the year 2007 only 6 Arab countries were able to occupy arrange in the GII index among 107 countries around the world. Kuwait was at the beginning of this rank regionally and ranked 30 globally. In the next year (2008-2009), the number of Arab countries that enabled to enter the GII ranking increased to 13 countries, Qatar came first with ranking 24 and the UAE with ranking 26 globally, while Kuwait fell to the third place in the Arab World and arranged 33 globally. In the same year, Jordan took good ranking reached 55 globally and 7 at Arab level, which showed a positive indicator of Jordan's ability to innovate. The following year (2009-2010) four countries of the GULF (Kuwait, Qatar, Bahrain, Saudi Arabia) respectively occupied the first ranking in the Arab World according the GII. Jordan was 5th rank regionally and 58 globally. For the next four years from (2011-2014) Qatar and UAE still at the beginning of the GII ranking at Arab World level and from the top 50 countries globally. UAE for (2013) and (2014) ranked 38 and 36 respectively followed by Saudi Arabia with ranking 42 in 2013 and 38 in

2014. The 2013 report showed Qatar at the third level among Arab world countries and 43 globally, while Kuwait took the forth place and 50 at the Arab level and globally. Jordan slipped down five place from (2012) with position 56 to becomes 61 worldwide and ranked 5 in the Arab world, It demonstrates above–par level of innovation compared with other countries with similar income level. None of the Arab world countries took rank higher than 38 in (2013) report, and only Saudi Arabia and Kuwait risen in the rank 6 and 5 places respectively. On the other hand, Qatar dropped 10 places, and other Arab countries (Lebanon, Tunisia, Oman, Morocco, Egypt, Algeria, Sudan, Yemen) stayed in the rare of the countries capable of innovation and get the latest ranking in GII. From (2014) report that ranked 143 countries, UAE came the first among Arab World countries, becomes in particular hub of innovation, due to its environment that encourages innovation This enable the UAE to stay in the front of Arab countries and took 36 place globally, followed by Saudi Arabia which continued progress to the top of ranking to get 38 order globally and 2 regionally. Jordan still in the 5 place at the Arab level but dropped down to 64 globally, Morocco ranked 84, Tunisia 78, Algeria still behind with ranking of 133. From the above, we can conclude that GCC countries UAE, Qatar, Saudi Arabia, Kuwait, Bahrain, and Oman become over years at the top of Arab World countries in their ability to innovate by creating suitable environment to engage in innovative activity and attract talents.

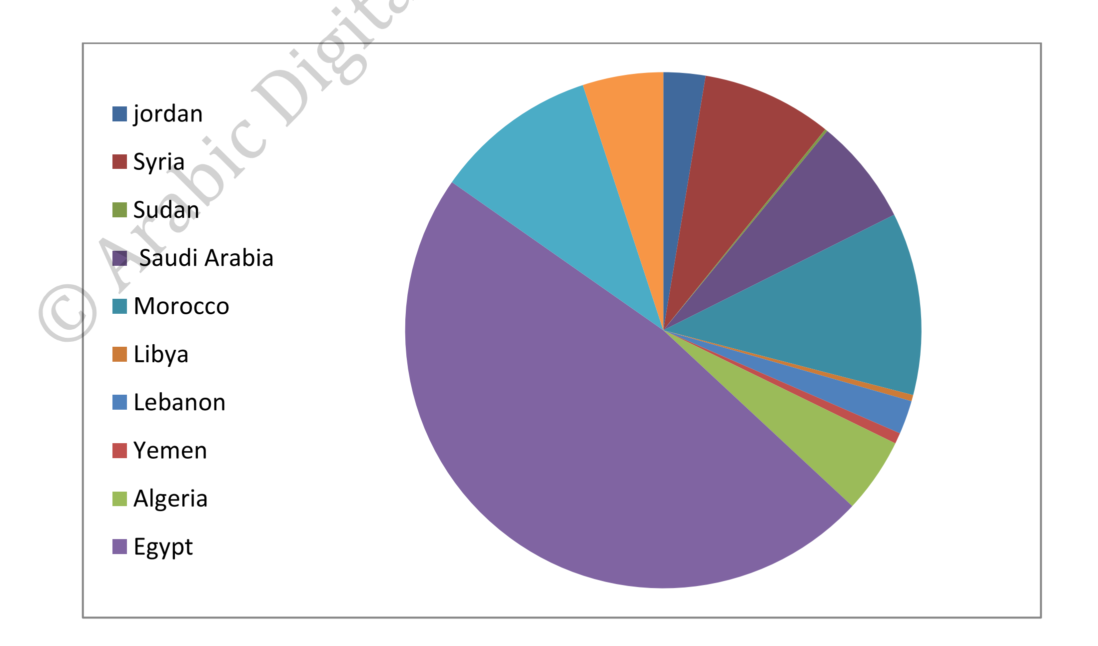
2-8-2 Patent in the Arab World

Innovation is different from research, and not all innovation is research-based. Patent is an indicator of innovation output and can be used to develop time series. In the desert of data for indicators measuring innovation, patent statistics used for this reason relative to its objectivity and its definition related to inventiveness.

Figure(2-1) shows the Arab Word total patent during (1963-2012):

Figure 2-1

Total Patent of the Arab World Countries during (1963-2013)



The chart above (2-1) represents total patent of the Arab world countries during the period (1963-2013). It can be shown that Egypt have the largest total of patent during that period, and Sudan occupied the smallest total patent. Jordan ranged between them where it reached total patent better than some other countries such as Sudan, Libya, Lebanon and Yemen.

Chapter

Literature Review

3-1 Introduction

Many studies investigate the innovation issue in different aspect, related to its key role that plays in economic growth. But the literature is silent on how access to finance by companies affects the innovation in developing countries at macroeconomic level, especially the finance from banks. The relation that link banking funding and companies innovation is not straightforward, and the ability of banks to fund innovation showed that the relation is naturally indirect (Ayyagri *et al.,* 2007). This chapter will review the previous studies related to this issue.

3-2 Previous Studies

The following section provides a review some of studies that examined the relation that link the banking development and innovation according to its sequential time:

1-Archibugi and Coco (2004) try to develop an index of technological capabilities for number of countries, relying on reliable sources of data. Where technological capabilities is a fundamental component of economic growth. The sample consist of 30 developed countries during the period (2000-2002). They used different indicators to

measure the technological capabilities, classifying them in four categories: the diffusion of new technology, the creation of technology, the diffusion of old technology and human skills which measured by share of secondary student in science and engineering. Other sub-indexes were add such as patent, scientific articles, literacy rate, electricity consumption and others. The results related to the human capital show that secondary school enrollment motivate the engaging in science and technology that develop innovation.

2- Falk (2005) examines the relationship between the patent (per 1,000,000 capita) and economic activates measured by different economic variables, particularly those under policy control. Using a panel of 22 OECD countries (Organization for Economic Co-operation and Development) with data measured as five year averages for the period (1980-1999). Patent was the dependent variable that represent the innovation, and economic variables such as: human capital (secondary school enrollment), GDP, and openness measured by (export plus import % of GDP), represent the economic activities. The results show that human capital intensity is significantly and positively related to patent per capita in the panel data model. GDP was also found to be significantly positively related to the patent per capita in most developed OECD countries, while it had little direct effect in least developed countries in the OECD. Also, it

finds that openness is not significantly and have less direct effect on patent per capita .

3-Tadesse (2005) investigates how financial development can be considered an important factor that affect growth through innovation that leads to technological progress, lowest cost production and risk sharing. Using a panel of ten manufacturing industries for thirty eight countries from the United Nation over the period (1980-1995), to examine these, relations. Financial development the 'independent variable' is measured by either stock market capitalization to GDP ratio that represents stock market development, or domestic credit to GDP ratio which represents banking sector development. The percentage change in technological progress the 'dependent variable' is measured after using the innovation in industries by the shift in the production frontier and the downward shift in average cost of production overtime holding other things constant. The finding shows that both bank and stock market developments are positively correlated to economic growth. Industries that achieved high technological progress have a higher level of financial development. Also, other evidence shows that real cost reduction and the share of productivity gain due to technological innovation are significantly bigger in countries in well–developed banking sector.

4-Al-Shaikh (2006) examines the amount of concerned done by software development firms in the innovation management process. This includes innovation input, processing and output. It tries to find if there is a link between these three constituents that's made up this process. In addition in attempts to determine the basic difficulties that prevent the introduction of innovation product and service in these software development firms and the extent that technical employees influence the number of innovation ideas converted to new product and service. To examine these assumptions, a questionnaire was conducted and given to 65 managers in 65 Jordanian firms in order to get the information about innovation management in all firms in the IT sector that develop software. The basic result was that software development firms interested in innovation at a satisfactory level, there is a positive relationship linked between the input and output of innovation and between the processing and output, lack of specially allocated budgets for innovation, little research and development expense, and other difficulties prevent innovation of new product or service in the IT firms. At the end, it finds that number of technical employees have a significant effect on the number of innovative ideas that are turn into new product and service.

5-Ayyagari *et al*., (2007) discuss the determinants of firms innovation by defining the innovation process (product and process) and other kinds of firms activities that consider one type of innovation these firms adapt. Taking into consideration firms characteristic factors such as size, age, legal states and industry sectors that affect innovation in these firms. In addition, shedding the light to the role of external financing sources in encouraging the innovation, using 19,000 firms in 47 developing countries. Innovation measured by either individual indicators or aggregate indicators, and other variables are used to controls firm level. All regressions are estimated using the logarithm probability and ordered logarithm models. To find the extent of innovation that undertakes by each enterprise depends on its characteristics and its increase related to the increase in firms size. Relative to the sources of financing, the results show that using external finance from foreign banks has a positive and significant effect on private companies innovation, while state-owned companies are less innovative with the external finance. Foreign banks financing has a higher rates of innovation relative to financing by local domestic banks. Loans have a positive and significant effect on all aggregate innovation.

6-Sharma (2007) explains how innovation in small firms are influenced by financial development. Also, discusses the correlation between spending on research and development in firms and the amount of

development. In addition, the study attempts introduce an evidence on the association between growth and financial development in industries that are considered innovation the basic determinant of productivity and the reason behind its growth. The random sample consists of 21,000 manufacturing firms from 57 countries include Eastern, Central Europe, Africa, South Asia and America, during (2003-2006). Innovation was measured by an aggregate index for new product, process and upgrading of existing product. Different variables used to measure banks development such as private credit/GDP, deposit accounts and interest rate spread. The results show that firms that largely using banks finance are those who doing research and development, and banks are the basic sources of financing to firms that engage in research and development countries.

7-Benfratello *et al.*, (2008) investigate how introducing product or process innovation by firms influenced by local banking development over the 1990s. Using a sample of Italian manufacturing firms through the period of (1994-2000), and branch density (number of branches divided by population) as proxy to measure the local banking development. Innovation is measured by quantitative information on the input and output of innovation process such as, research and development and fixed investment spending. Logarithm and liner probability models used to experiment the data, they find a proof that local banking development has a significant and

positive effect on both process and product innovation after controlling other variables. For process innovation small firms, high tech sectors and firms more dependent on external finance are affected largely by local financial development. Meanwhile the proof is weaker for product innovation. Other evidence is that banking development decreases the cash sensitivity of fixed investment spending for small firms and increases their probability in engaging research and development

8-Veysov and Stolbov (2011) study the relation that link banking development and decreasing financial constraints with innovation activity in Russia, using a panel of data for 75 constituent territories of Russia during the period (2001-2008). Different indicators were used to measure both the development in banks and innovation activities. The innovation measured by number of researchers engaged in research and development, patents applied by domestic patentees, number and proportion of firms achieved innovative activity and the amount of innovative production as a percentage of GDP, while the banking development measured by banking depth (asset of banking institutions/GDP), credit depth (credit outstanding of corporate bodies) and ownership concentration in banking sectors. The main results indicate that innovation in Russia is facilitated by banks. Other results show that finance and innovation relationship is new and rarely covered. In developing countries, banking institution with and without

government ownership can haste innovation and they are more appropriate for incremental innovation.

9-Xiao and Zhao (2011) investigates how financial development represented by stock market and banking sector development affects firm's innovation at micro-level, which in turn accelerates the economic growth. A data of 50,000 firms from 46 countries during the period (2002-2005) used to examine these relations. Regressions estimated by logarithm and ordered logarithm models, where the financial development measured by stock market capitalization/GDP, bank credit/GDP and government ownership of banks. Firms innovation measured by two approaches: Firstly, developing individual and aggregate indictors after distributing a questionnaire to the firms. Secondly, using the number of US patent as well as the number of citation of those patents at patent-class level. The findings show that aggregates and individuals innovation measures are positively and significantly influenced by stock market development, while banking sector development has a mixed effects on those measures of innovation, higher government ownership of banks results in a lower level of firms innovation and this impact is significantly stronger for small firms. In addition to its negative effect on the number of patents and their citation. In conclusion the empirical evidence has shown that financial development

promotes economic growth at the macroeconomic level while the microeconomic evidence is quite limited.

10-Amore *et al*., (2012) examine whether financial development represented by interstate banking deregulation has a positive impact on companies innovative performance, where innovation plays an important role in technological progress and economic growth. Collecting set of data on financial characteristic for U.S publicly traded companies during a period of interstate banking deregulation from (1980-1990), and focusing on companies innovation performance which was measured by numbers of successful patents application. Meanwhile a binary variable and loans supply data used to measure the interstate banking deregulation .The results show that interstate banking deregulation had a significant beneficial effect on innovation activities especially for firms that highly dependent on external financing, and the rises of these activities related to a better ability to diversify credit risk by out-of-state banks which leads to leading borrowers with higher risk.

11-Chava *et al*., (2012) examine how finance affect economic growth through innovation exploit the deregulation of banks as indicator of financial development. The data include a sample of 1,581 observation from 51 states during the period (1975-2005), where the independent variable intra-state and inter-state deregulation are used to represent banks

deregulation. The dependent variable "Innovation" measured by using two proxies; the number of patents filed by companies and the number of citation the patent receive. A simple theoretical model was built to derive this relation. The results show that intra-state deregulation reduces both the level and riskiness of innovation by young private companies, while inter-state deregulation raises them. Banking deregulation has no effect on public and large private companies that less relying on bank financing. The evidences show that finance have a positive externality on economic growth through the innovation channel.

12-Bazine and Svensson (2013) investigate the link between innovation and multiple forms of financial marked development. Using OLS model to test these relations, and firm level data for 12,500 manufacturing companies from 54 countries during (2002-2006), where these data include research and development expenditures as a proxy to innovation. A different variables represent financial development such as bank credit/ GDP, interest rate spread, number of deposit, ratio of stock traded to stock market capitalization. The finding explained that companies size and financial development has a robust positive association with the probability of a company engaging in research and development. in turns, small companies are more productive than larger ones in term of R&D,

where when financial development increase, the level of innovation between small and large companies decrease.

13-Bircan and Haas (2013) examine how Russian firm's innovative activities are influenced by access to bank credit and which types of firm's innovation would be affected most; beside determination, if these innovative activities influenced by bank ownership types. Combining three pieces of information about the geographical location of Russia bank branches, firms credit constraint and firm innovation data. Using a sample of 4,200 Russian firms and 45,000 branches of domestic private bank, foreign banks and state-owned banks, Other data about the identity of main creditor, and innovation activities representing by Core innovation that include both product and process. The study find that more innovative firms those who have better access to banks credit, and have the ability to introduce higher new product and process. Also, they find banks play an important role in motivation technological progress in emerging market, small and opaque firms are less constrained.

14-Cornaggia *et at*., (2013) disuse if banking competition influence innovation through the deregulation of interstate bank branching law. The sample contains U.S listed corporations and private companies during (1976-2006), in which, the innovation measured by number of patent application and number of citations received in subsequent years, an index

of interstate branching deregulation was built to measure the banking competition. The empirical result find proof that deregulation the state level branching law leads to decreasing state level innovation, while the innovation raise among external finance–dependent private companies through increase reach to credit and relaxes the financial constraints of these private companies which allowing them to secure bank financing and innovative projects.

15-Mehmood (2013) explains how innovation is facilitated by better access to external finance taking a macroeconomic viewpoint to show the effect on economic development. Incorporate aggregate data and multiple innovation measures to get the overall effect of access to finance, using a panel of 76 countries during (1988-2010), and logarithm of bank credit and market capitalization as proxies to measure the access to finance. Innovation was measured by the logarithm of patent applications and number of R&D expenditures. It's find that better access to both capital and banks market positively affecting innovation, however, innovation so far increased by bank lending where it increase innovation, especially in developing countries, and this positive relation stems from bank as opposed to capital market lending with the impact financing from bank more used in less income countries.

16-Pellegrina *et al*., (2013) explain how banks with different size rewarded more innovative companies in the terms of credit granted and reaching to external financing, by gathering quantitative and qualitative information for each company. Using data for a 6,025 small Italian companies from different database during the period (2009-2011), and different measures to the bank lending and innovation in these companies. Innovation measured by process and product innovation. The results show that banks reward innovative companies regardless of their dimension. Banking system prefer to support innovative companies rather than non-innovative ones, large internationalized banks seem more willing to finance product innovation, whereas no difference between small and large banks in providing credit to small companies for process innovation.

3-3 What Distinguish This Study From Previous Studies

As seen from the previous reviews of most studies covers the issue of banks development, innovation and factors related to this issue, were conducted in the developed countries. The importance of this study comes from the lack of similar ones that investigated this issue in developing countries, where to the best of the researcher's knowledge this is the first one to be conducted in the Arab World at macroeconomic level, related to innovation basic role in growth and productivity.

The motivation comes from viewpoint of Rajan and Zingales (1998) who introduce a proof that firms and industry level which have less access to external finance leads to reduction in their growth rats. Levine *et al.*, (2000) who explained that financial development of different sectors facilitate capital accumulation and recourses allocation. This study is similar to Falk (2005) study but introduce banks developments as independent variable .

Table (3-1)

Summary of Previous Studies

Name of Study and author	Objective of Study	Period and sample of Study	Country of the study	Methodology and variables	Results of Study
A New Indicator of Technological Capabilities for Developed and Developing Countries (ArCo) **Archibugi and Coco (2004)**	develop an index of technological capabilities for number of countries, relying on reliable sources of data	30 developed countries during the period (2000-2002)	30 developed countries	They used different indicators to measure the technological capabilities, classifying them in four categories: the diffusion of new technology, the creation of technology, the diffusion of old technology and human skills which measured by share of secondary student in science and engineering. Other sub-indexes were add	The related to human capital show that secondary school enrollment motivate the engaging in science and technology that develop innovation
What determine patent per capita in OECD Countries?	examine the relationship between the patent per 1 million capita and economic	22 OECD countries during the period (1980 -1999)	OECD countries	Patent per 1 million capita was the dependent variable that represent the innovation, where used different	human capital intensity are significantly positively related to patent per capita in the

Falk (2005)	activates using different economic variables ,particularly those under policy control			economic variables such as: human capital (secondary school enrollment), GDP, and openness that measured by (export plus import % of GDP), to represent the economic activities	panel data model. GDP significantly positively related to the patent per capita in most developed OECD countries openness is not significantly and have less direct effect on patent per capita
Financial Development and Technology **Tadesse (2005)**	Investigated how financial development could affect economic growth through innovation	1980-1995	Ten industri es across 38 countri es	Cross – country Cross– industry Regression (RZ methodology) and the variables: banks development measured by domestic credit /GDP and innovation measured by shift in production frontier and real cost reduction of productivity	banks development positively correlated with economic, real cost reduction and productivity gain are larger in countries with well-developed banking sectors
Innovation Management in Developing Countries : The Case of Software Developing Companies in Jordan **Al-Shaikh (2006)**	Examined the amount of concerned by software development firms in innovation management process and determine the difficulties that prevent innovation in these firms	65 managers in 65 Jordanian firms	Jordan	Using a questionnaire for collecting data and the Statistical Package for Social Science (SPSS).	software development firms interest in innovation at a satisfactory level, lack of specially allocated budgets for innovation including the little research and development expense and other difficulties prevent innovation of new product or service in the IT firms
Banks and Innovation : Micro econometric Evidence	They investigated how introducing product or process	1994-2000	Italy	Simple Pooled Legit Model and Liner Probability Model. The variables: branch density (number of branches divided by	Find a proof that local banking development has a significant and positive effect on both process and

Benfratello *et al*. (2006)	innovation by firms influenced by local banking development			population) as proxy to measure the local banking development, where innovation was measured by research, development, and fixed investment	product innovation
Firms Innovation in Emerging Markets **Ayyagari*et al*. (2007)**	discussed the determinants of firms' 47 developing countries innovation by defining the innovation process (Product and process) also other kinds of firms activities that consider one type of innovation those firms adapt	19,000 firms	47 developing countries	Using Logit Probability Model and Ordered Logit. The variables: Innovation in companies measured by either individual indicators or aggregate indicators in the time that other variables are used as firm level controls.	using of external finance from foreign banks has a positive and significant effect on private companies innovation, state owned companies are less innovative with the external finance. Foreign banks financing has a higher rates of innovation relative to financing by local domestic banks.
Financial Development and Innovation in Small Firms **Sharma (2007)**	explained how innovation in small firms influenced by financial development introduce an evidence on the association between growth and financial development in industries that considering innovation the basic determinant of productivity and the	2003-2006 sample of 21,000 manufacturing firms	57 countries	OLS Regression The variables: Innovation measured by an aggregate index for new product, process and upgrading of existing product, while using different variables to measure banks development such a private credit/GDP, deposit accounts and interest rate spread	find that firms largely using banks finance are those who doing research and development and the banks are the basic sources of financing to firms that engage in research and development countries.

	reason behind this growth.				
The Impact of Financial Sector on Innovation Activity: Theoretical Background and New Evidence From Russian Banking Sector **Veysov and Stolbov (2011)**	studied the relation that link banking development and decreasing financial constraints with innovation activity in Russia	2001-2008 The sample included 75 constituent territories of Russia	Russia	1. Pooled OLS estimator (not using longitudinal data structure); 2. LSDV estimator (Least Squares Dummy Variables); 3. Within estimator or Fixed Effect (FE) estimator; 4. Random effect estimator. The variables: Innovation measured by number of researchers engaged in research and development, patents applied by domestic patentees, number and proportion of firms achieved innovative activity and the amount of innovative production as a percentage of GDP , banks development measured by banking depth (asset of banking institutions/GDP), credit depth (credit outstanding of corporate bodies.	The main result indicated that innovation in Russia is facilitated by banks ,where other general results showed that finance and innovation relationship is new and rarely covered
Financial Development , Government Ownerships of Banks and Firms Innovation **Xiao and Zhao (2011)**	investigated how financial development affects firm's innovation at micro-level which in turn accelerates the economic growth at the macro-level.	2002-2005 50,000 firms from 46 countries	46 countri es	Logit Model and Ordered Logit Model. The variables : financial development measured by stock market capitalization/GDP, bank credit/GDP and government ownership of banks. Firms innovation measured by individual and aggregate indictors	findings showed that aggregates and individuals innovation measures positively and significantly influenced by stock market development, while banking sector development has a mixed effects

				after distributing a questionnaire to the firms, the number of US patent as well as the number of citation of those patents at patent-class level	on aggregate and individual measures of innovation.
Credit Supply and Corporate Innovation **Amore *et al*. (2012)**	examined whether financial development has a positive impact on companies innovative performance	1980-1990	U.S states	Using Difference –in Difference Model and OLS regression . The variables: companies innovation performance was measured by numbers of successful patents application , while a binary variable and loans supply data used to measure the interstate banking deregulation	result showed that interstate banking deregulation had a significant beneficial effect on innovation activities especially for firms that highly dependent on external financing
Banking Deregulation, Bargaining Power and Innovation **Chava*et al*. (2012)**	examined how finance affect economic growth through innovation exploit the deregulation of banks	1975-2005 sample of 1,581 observation from 51 states	51 states	Descriptive Statistic for a Panel of all firms in the sample. The variables: intra-state and inter-state deregulation are used to represent banks deregulation Innovation" measured using two proxies; the number of patent filed by companies and the number of citation the patent receive	result showed that intra-state deregulation reduces both the level and riskiness of innovation by young private companies, while inter-state deregulation raises them
Innovation and Financial Development From Global Perspective **Bazine and Svensson (2013)**	investigated the link between innovation and multiple forms of financial marked development	2002-2006 Sample of12,500 manufacturin g companies from 54 countries	54 countri es	OLS estimation. The variables: research and development expenditures used to measure innovation, where financial development measured by bank credit/GDP, interest rate spread, number of deposit, ratio of stock traded to stock market capitalization	company size and financial development has a robust positive association with the probability of a company engaging in research and development D and fined that when financial development increase, the level of innovation

					between small and large companies decrease.
Bank Lending and Firms Innovation :Evidence from Russia **Bican*et al*. (2013)**	examined how Russian firm's innovative activities influenced by access to bank credit and which types of firm's innovation would affected most	Using a sample of 4,200 Russian firms and 45,000 branches of domestic private bank, foreign banks and state-owned banks	Russia	OLS regression. The variables: innovation activities representing by Core innovation that include both product and process	Find that more innovative firms those who have better access to banks credit Also find that banks play an important role in motivation technological progress in emerging market
Dose Banking Competition Affect Innovation **Cornaggiaet*et at*. (2013)**	discussed if banking competition influence innovation through the deregulation of interstate bank branching law	1976-2006	U.S states	OLS regression. The variables: innovation measured by number of patent application and number of citations received in subsequent years ,an index of interstate branching deregulation was built to measure the banking competition	find proof that deregulation the state level branching law leads to decreasing state level innovation, while the innovation raise among external finance-dependent private companies
Access To External Finance and Innovation : A Macroeconomic Perspective **Mehmood (2013)**	explained how innovation is facilitated by better access to external finance taking a macroeconomic viewpoint	1988-2010 using a panel of 76 countries	76 countries	GMM difference and system estimators. The variables: logarithm of bank credit and market capitalization used as proxies to measure the access to finance, Innovation was measured by the logarithm of patent applications and number of R&D expenditures	find that better access to both capital and banks market positively affecting innovation, however more so far for bank lending where it increase innovation, especially in developing countries

Dose Bank Size Matter in Financing Small Business Innovation **Pellegrina*et al*. (2013)**	explained how banks with different size rewarded more innovative companies in the terms of credit granted and reaching to external financing	2009-2011	Italy	Using GMM estimation and pooled regression. The variables: innovation measured by process and product innovation and used different measures	find that banks reward innovative companies regardless of their dimension. Banking system prefer to support innovative companies rather than non-innovative ones, large internationalized banks seem more willing to finance product innovation

Chapter Four

Data and Methodology

4-1 Introduction

This chapter aims to present the methodology of study. Starting with identifying the population, sample, main sources of data and the most important statistical tests applied. Also, it presents the model that used to explore the relationship between variables and how each one is measured based on previous studies.

4-2 Population and Sample of Study

Population of study consists of all Arab countries (22 countries). The sample of the study consists of (19) countries where we exclude (3) countries because of insufficient data during the period (1963-2012). The Appendix 1 and Appendix 2 contain the countries name that consist the population and sample. Table (4-1) provide information about the percentage of sample from population.

Table (4-1)

Population and Sample of the Study

	Numbers of Countries	**Percentage (%)**
Population	22 counties	100
Sample	19 countries	86%
Countries Excluded	3 countries	14%

4-3 Data Sources

Data of the study is collected from secondary sources from the World Bank indicators, which used to measure the effect of banking development on innovation in the Arab World at macroeconomic level. Also, used data bases and library to get articles and previous studies that investigated this issue to cover the literature review and the theoretical framework.

4-4 Statistical Method

To examine the effect of banks development on innovation in the Arab World during the period (1963-2012), the following statistical analyses are used:

1-Descriptive Statistic: to describe the data such as mean, standard deviation, maximum and minimum values for each variable.

2-Variance Inflation Factor (VIF): to examine the correlation between the variables, and explore the mulicollinearity problem between set of independent variables in the multiple regression model. VIF less than (10) indicates to absence of multicollinearity. Also, (1/ VIF) indicate the accuracy of each variable interpretation (Hsieh *et al*., 2003).

3-Breusch- Pagan Test: to detect the problem of heteroscedasticity that could be included in the data of study in the liner regression model when testing the null hypothesis. This hypotheses accepted if the (Ch-Square) distribution doesn't have any statistical significant at (5%). If the F-test confirms that the independent variable are significant, then the null hypothesis can be rejected (Breusch and Pagan, 1979).

4- Stationary Test (Unit Root Test): to examine if time series data stationary or not stationary, by using Augumented Dickey–Fuller Test (ADF) which is one of the most important testing for Unit Root (Gujarati, 2003, p817).

It can be explained through the following formula:

$$\boldsymbol{Yt = \beta 1 + \beta 2T + \delta\, Yt - 1 + \sum_{n=1}^{m} \alpha\, i\, \Delta\, Yt - 1 + \Delta \varepsilon_t}$$

Where $\mathbf{Y_t}$ represents the dependent variable(innovation) in year t, $\boldsymbol{\varepsilon}$ is the error term, and **m** indicates the sufficient lag length to cancel the autocorrelation for error term. Rejecting or accepting the null hypothesis

depend on the **t** value which extracted from Mackinnon table. If the **t** value calculated (absolute value) greater than critical value, reject the Unit Root hypothesis, and then can say the time series is stationary. If the **t** value less than critical value, accept the null hypothesis, and the time series is non-stationary (Gujarati, 2003). In the second case, we take the first difference for the variables and test again the ADF, until it become stationary, then we can say it's stationary at the first level .

5-Multiple regression analysis by using Ordinary Least Square (OLS): to examine the nature of relations between the dependent and independent variables, test the hypotheses, and used (F- test) to ensure the significance of the model and (T- test) to examine the significance of the independent in affecting dependent. Its consider one of the best analysis that enable the researchers to control the multiple factors that influence the dependent variable at one time (Zainodin *et al*., 2011).

4-5 Model of the Study

To explore the effect of banks development on innovation, (OLS) is applied, which is expressed in logarithmic value (Mehmood, 2013 and Falk, 2005), since logarithmic liner equation is mostly applied for demand model, were estimated coefficient are described as elasticities.

$$\mathbf{L\,(INNO)_t = \beta_0 + \beta_1\,L(BNK\ DEV)_t + \beta_2\,L\,(EC\ GR)_t + \beta_3\,L(EDU)_t + \beta_4\,L(OPN)_t + \varepsilon_t}\,.$$

Where:

1-INNO (Innovation), the dependent variable is measured by patent per capita per 1,000,000 person.

2-BNK DEV (Banks development), the independent variable, is measured domestic credit to privet sectors by Banks (% of GDP).

3-EC GR (Economic Growth), is measured by GDP which is the of Gross Domestic Product per capita (Current US $).

4-EDU (Education), is measured by secondary school enrollment as a percentage of the population of official secondary education age (% Gross).

5-OPN (Openness), measured by trade (% of GDP).

6-The parameter $\beta 0$ is an intercept.

7-The coefficients B_1, B_2, B_3, and B_4 are unknown parameters for the independent variables.

8- ε_t is the Error Term.

9- L represents logarithms.

4-6 Hypothesis Development

Innovation is the dependent variable for this study. Banks development is the independent variable. While the economic growth, education and openness are control variables.

4-6-1 Dependent Variable: Innovation

it is measured by patent application, resident per 1,000,000 capita, filed through national patent office where new products, processes or technique created to do something or provides solution to a problem. This patent offers an exclusive right for an invention and protect its owner for a period of time generally 20 years. Also, prevent anyone else from the production or use after an examination to the novelty of the claimed item and its utility (World Bank, 2013). Patent are considered the best indicator of economic innovation outputs (Gill *et al*., 2007), used to measure new knowledge, and to adjust for the size of economy (Falk, 2005).

It's used in many studies such as:

Lachenmaier and Rottmann (2011) where they showed that patent used to measure the innovation, related to its ability to capture the highest and most important innovation due to the high cost associated with patent application.

Mehmod (2013) indicated that the logarithm of annual patent applications of resident is still the baseline of the innovation measures.

Grilliches (1998) analyzed patent widely at micro and macro-level and documents the advantages of using patent application as proxies for innovation activities.

The data for patent in this study dated according to each years that Arab World countries were applied to filled an application for patent, and divided those patent by 1,000,000 capita.

4-6-2 Independent Variable: Banks Development

It is measured by domestic credit to private sectors by banks as a percentage of GDP (World Bank, 2013). It is preferred measure because it is considered more than a simple measure of banking size development.

This indictor represents the overall development in the banking sector, by measuring the quantity and quality of innovation activity financed by banks (King and Levine, 1993a), correlated with the long-term economic growth and the reduction in the poverty (Demirgüç-Kunt and Levine, 2013), isolate the credit issued to privet sectors from other credit issued to government, public sectors and government agencies.

Most studies used domestic credit to private sectors (% of GDP) to measure the banks development such as Mehmood (2013) who used the logarithm of this indicator and explained it represent total loans granted to private sectors, to capture both demand and supply effect. Other studies by

Xiao and Zhao (2011), Bazine and Svensson (2013), Tadesse (2005) and Sharma (2007), used this indicator and defined the private credit in their studies as total credit from deposit–taking institutions to the private sectors.

Banks development expected to have a positive impact on innovation at the macro-level, where it raises the availability of fund that facilating the innovation process by firms, improve saving, allocation of capital and reduce the financial constraint that most innovative firms suffering from (King and Levine, 1993 a and b).

Therefore the following hypothesis will be tested:

H_{01}: There is no statistical significant relationship between banks development and innovation in the Arab World.

4-6-3 Control Variables:

There are other factors that affect the innovation other than banks development at the macroeconomic level such as: economic growth, education and openness.

1-Economic Growth

It is measured by the Gross Domestic Product per capita (GDP) at current us dollar, where Gross Domestic Product is a measurement of the society wealth, indicates the growth of profits and expected return on capital. Therefore, it uses to gauge on the health and well-being of the

economy beside uses as indicator of country income level (Litra, 2009). Because financial development is highly correlated to the total income of the economy, GDP is expected to have a positive impact on the innovation at the macro-level, where Its raising reflect the raising of credit availability in the economy, which is necessary for innovation activates.

A number of researchers used the GDP as a control variable in their studies such as: Xiao and Zhao (2011) where they used it as macroeconomic control variable for the access to finance. Amore *et al.,* (2012) also included it in their study methodology as a state level macroeconomic control. Ayygari *et al.,* (2007) made control on the level of country development by using the GDP per capita. Mehmood (2013) stat that GDP control the demand for credit effect while it isolate the supply effect.

Therefore, the following hypothesis will be tested:

H_{02}: There is no statistical significant relationship between economic growth and innovation in the Arab World.

2-Education

One of the basic factors that determine the innovation capability and drive the growth is the quality and talented ofhuman capital,that created by each country through building education infrastructure (schools, colleges

and academic research and development institutions) in order to develop the knowledge of its population in the different innovation areas (INSEAD, 2013). Access to basic and secondary education is key to innovation.

Developing countries should invest more in education to establish base for qualified human capital which drive growth and enhance productivity of research activities, raising the aggregate supply of skilled labor and decreasing the cost of research and development (Aghion *et al*., 2004). It is consider an endogenous growth factor for each country, where the educated labors foster the innovation (Aghion and Howitt, 1998). Education is measured by secondary school enrollment which is the total enrollment in secondary education regardless of age.

Therefore, the following hypothesis will be tested:

H_{03}: There is no statistical significant relationship between education level and innovation in the Arab World.

3-Openness

The expansion of trade has reshaped the economy and serve as major channel for technology transfer. It enhances productivity and super innovation (Miroudot *et al*., 2013). Many factors include population, trade policy and culture limit a country volume trade measured as percentage of GDP. In defining openness, Pritchett (1996), state that economy trade

intensity, refers to the degree to which economies or nations have trade with others. The established effect of openness ratio on innovation across countries could be done by enterprises better access to finance, foreign enterprises export through their partner have easier access to finance, and their policies of export missing the barriers to trade, which raise their ability to innovate. (Almeida and Fernandes, 2008).

Fagerberg and Srholec (2008) also, identified openness and access to bank credit as basic elements for developing, search for and exploit knowledge commercially.

On the other hand openness have a positive effect on innovation, where the trade could generate externalities by enable enhancing knowledge and allows for exchange ideas that increases innovation capability (Roper *et al*., 2013).

Therefore, the following hypothesis will be tested:

H_{04}: There is no statistical significant relationship between openness and innovation in the Arab World.

Table (4-2) provides a summary of the variables used in the study and their measurements.

Table (4-2) will contain a summary for study variables, how they measured and the predicted singe for the independent variables:

Table (4-2)

Variables of the Study

The Variable	How its measured	Predicted singe	Data Sources
Dependent Variable			
Innovation	Log of Residual Patent, per 1,000,000 Capita		World Bank, World Development Indicator (WDI)
Independent Variable			
Banks Development	Log of Domestic credit to private sectors by banks (% of GDP)	+	World Bank, World Development Indicator (WDI)
Control Variables			
Economic Growth	Log of Gross Domestic Product (Current Us $)	+	World Bank, World Development Indicator (WDI)
Education	Log of School Enrollment, Secondary (% Gross)	+	World Bank, World Development Indicator (WDI)
Openness	Log of Total Trade (% of GDP)	+	World Bank, World Development Indicator (WDI)

Chapter Five

Data Analysis and Hypotheses Testing

5-1 Introduction

This chapter presents the estimation statistical results of the study, discusses its findings and hypotheses testing. Introduces a brief interpretation of the empirical forecasted results based on the model presented in the previous chapter.

5-2 Descriptive Statistics for Regression

Table(1-5) presents the summary of descriptive statistics of the data of the study:

Table (5-1)

Descriptive statistic for Regression

Study Variables	No. of Obs	Mean	Standard Deviation	Minimum Value	Maximum Value
Innovation	50	2.145	.9198	.7310	4.0496
Bank Development (%)	50	26.04	10.43	10.81	47.11
Economic Growth ($)	46	2606	1880	293.6	7709.9
Education (%)	43	50.14	14.49	25.09	71.99
Openness (%)	45	75.52	11.61	58.78	100.56

Based on the result in table (5-1), the descriptive statistics show that:

The mean of patent per capita per 1,000,000 reach (2.145) for the Arab World, which means that each 1 million person in the Arab Word produce only (2) patents during the period (1963-2012), and this shows a very low level of innovation. The standard deviation from mean reached (.9198) and that's related to the disparity in the Arab World countries ability to innovative, because some of these countries are more developed than others, where the values ranged between (.7310) as a minimum and (4.0496) as maximum.

Banks development mean reach (26.04%) for the Arab World which is an indicator on the rising role of banks in financing private sectors in the Arab World. Standard deviation (10.43%), indicated a large deviation from the mean, because the sample included countries with less development in their banking sectors and still don't have ambiguous role in financing innovation, it has been observed a great disparity between the minimum (17.235) and maximum (47.109) values.

The GDP per capita means was (2606) for the Arab World which is an indicator on the lower level of growth in their economies and national incomes, where the standard deviation for these Arab World was (1880), which indicate a high variation refers to disparity between countries in their economy development where some countries achieved higher GDP while

the others suffer from lower levels. The minimum and maximum values ranged between (293.6 to7709.9) respectively.

The mean of education variable reach (50.14%) for the Arab World, that indicated a higher level of secondary school enrollment in most Arab countries, and indicate to the increasing in the innovation capability, where the standard deviation for this percentage reached (14.49%) and the minimum and maximum values ranged between (25.09%) and (71.99%) respectively. This shows that there is differences in the education percentages in Arab world countries included in the sample, where some of countries don't have strong education infrastructure .

Openness means reach (75.52%) for the Arab World, which is a higher value indicate to large level of exports and imports as percentage of GDP, as a result of increasing the innovation products and services in Arab World countries. Standard deviation (11.61%) reflect a higher deviation from the mean and higher divergence between the minimum value (58.78%) and the maximum value (100.56).where some of these countries may have a constraint on international trade, that means not all Arab world countries have a higher percentage of openness, its restricted to the most developed countries.

5-3 Variance of Inflation Factor (VIF)

The problem of multicollinerity is evaluated in the model of the study as shown in table (5-2):

Table (5-2)

Testing Problem of Multicollineriaty

The variables	VIF	1/ VIF
Bank Development	1.02	0.977032
Economic Growth	1.14	0.880738
Education	1.10	0.910802
Openness	1.04	0.957190
Mean	1.08	

Based on the above table (5-2):

The result of (VIF) shown no problem of multicollinerity, where the mean of VIF for the variable is (1.075) and the values ranged between (1.02) and (1.14) which is less than 10.

5-4 Breusch –Pagan Analysis

The problem of hetroskedasticity is evaluated in the model of the study as shown in table (5-3):

Table (5-3)

Breusch –Pagan Analysis

Chi2	4.77
Prob> Chi2	0.3118

Based on the above table (5-3) the results of the Breuch–Pagan test indicate the acceptance of the null hypotheses where Chi2= 4.77, which means it is not significant at 5%. The result implies the absence of hetroskedasticity.

5-5 Standard Methods Used in the Analysis

Many studies showed that a large number of time series data characterized by non-Stationary, as a result of its inclusion for Unit Root, Which means that the mean and discrepancy of variable not independent across time, and most of them include trend factor, that reflect certain circumstances influence all variables in the same trend or opposite trend. Also, the absence of Stationary could make the estimation result obtained

Spurious Regression, and doesn't introduce any economic explanation with meaning, although Squared coefficient is high (Gujarati, 2003).

The Augmented Dickey–Fuller (ADF) conducted to test existence of unit Root or not using the intercept.

Table (5-4)

Augmented Dickey-Fuller Test for Variables of the Study

The Variable		ADF Calculated Value	Critical Value at 5%	Decision
Innovation	Level	-3.188	2.933	Stationary
Education	Level	-3.735	-2.952	Stationary
Bank Credit	Level	-1.231	-2.928	Non Stationary
	First Difference	-10.854	-2.929	Stationary
GDP	Level	-1.991	-2.944	Non Stationary
	First Difference	-4.653	-2.947	Stationary
Openness (Trade)	Level	-1.575	-2.947	Non Stationary
	First Difference	-6.619	-2.950	Stationary

(*)Stationary at 5%

Critical values according to tabulated values for (Mackinnon,1996) : 1%=-3.55, 5%=-2.91, 10%=-2.59

Sources : by researcher based on Stata output

The result of the ADF indicates that the null hypothesis was accepted for both variables innovation and education, which means that these variables are stationary and have not unit root at the level. On the other hand, the null hypothesis was rejected for the variables banks development, openness and economic growth, consequently, we took the first difference and test again the ADF for these variables, where we found that its stationary at the first level.

Consequently the following model is applied:

$$\mathbf{L(INNO)_t = \beta_0 + \beta_1 \Delta\, L(BNK\ DEV)_t + \beta_2\, \Delta\, L\ (EC\ GR)_t + \beta_3\, L\ (EDU)_t + \beta_4\, \Delta L\ (OPN)t + \varepsilon_t}$$

Where:

1-INNO (Innovation), the dependent variable measured by patent per capita per 1,000,000 person.

2-BNK DEV (Banks development) the independent variable measured by Domestic Credit to Privet Sectors by Banks (% of GDP).

3-EC GR (Economic Growth) measured by GDP which is the Gross Domestic Product per capita (Current US $).

4-EDU (Education), measured by School Enrollment, Secondary as a percentage of the population of official secondary education age (% Gross).

5-OPN (Openness), measured by trade (% of GDP).

6-The parameter $\beta 0$ is an intercept.

7-The coefficient $\beta 1, \beta 2, \beta 3, \beta 4$ are unknown parameters for the independent variables.

8- **εt** is the Error Term.

9- L represents logarithms.

10- Δ represents first difference.

5-6 Multiple Regression Results

Table (5-4) present the results of OLS regression:

Table (5-5)

Results of Multiple Regression Analysis

Variables	OLS-Results
Intercepts	.6459 (0.000)*
Bank Development	.2732 (.073)***
Economic Growth	.1791 (.671)
Education	1.1326 (0.000)*
Openness	.6122 (.393)
Adjusted R- Squared	55.02%
F- Statistic	13.84 (0.0000)*

p-values are between parantheses *,,***,sig. at 1% ,5% and 10%**

The model is significant at less than 1% level of confidence.

The result explain the ability of independent variable in the model in explain (55%) of the variation occurred in patent per capita representing in the sample of study, where the Adjusted R-Squared reached (0.5502) in the regression model used. A (45%) of variation related to other variables not included in the model.

5-6-1 Result Discussion and Hypotheses Testing:

H_{01}: There is no statistical significant relationship between banks development and innovation in the Arab World.

The Results show that there is a positive relationship between domestic credit to private sector by banks (banks development) and innovation, however it is significant at 10%. Therefore, we accept the null hypothesis and reject the alternative one, however the null hypotheses rejected at 10%.

This means that banks market important and have a major role in financing innovation by raising the credit to private sector which suffer from financing constraint and requisite the credit to engaged in innovation process to produce benefit at micro and macro level.

Banks development also reduce cost of raising capital by improve saving for a better supply (King and Levine,1993a and b). Our result in consistent with previous studies such as Mehmood (2013) who makes sure that access to bank credit being more important for innovation in developing countries, he explained that economically and statistically large bank coefficients point toward stronger of this relation. Tadesse (2005) found that banking sector development is also positively and significantly correlated with innovation and economics, where they increase the

financing and reduce cost which enhance innovation and productivity. Bircan and Haas (2013) indicated that more innovation enterprises those who have a better access to banks credit, and provide evidence on the banks fundamental role in motivating technological process in emerging markets especially in developing countries.

H_{02}: There is no statistical significant relationship between Economic Growth and innovation in the Arab World.

The results show that there is no statistical significant relationship between GDP and innovation in Arab Word. Therefore the null hypothesis can not be rejected.

Most studies for developed countries found a positive and significant relationship between the GDP and innovation, on the other hand, this study find positive but not significant relation, it can be explained that most of them still in developing stage, having low or medium level of national income compared to other developed countries which have financial development controlled by this macroeconomic variable (Ayygari *et al.,* 2007).

Some evidence indicated a strong empirical support that higher GDP reflect the credit availability and its demand in economy, where the lower GDP levels for most Arab World countries reduce the credit availability needed for engaging in innovation investment projects, that causes the

insignificant relation in this study. Our results are consistent with the result of Falk (2005) who found positive and insignificant relation of GDP per capita with innovation for his sample for the less developed OECD countries, on the other hand, he found a positive and significant relation for the rest developed countries.

H_{03}: There is no statistical significant relationship between education level and innovation in the Arab World.

The results show a positive and significant relationship between education and innovation in the Arab World at 1% significant. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted.

Education infrastructure is considered as one of the major innovation capabilities that drive growth at macro-level in the Arab World. different levels of education help in enhancing knowledge and develop the mental capacity for population that exploited in different innovation areas. Secondary school enrolment specifically lead to create skilled labour force who are engaged in the research and development activities, beside decreasing the cost of this research and enhancing the innovation capability of the labour by being more productive (INSEAD, 2013).

Our results is consistent with Archibngi and Ccoc (2004) who measure education of human capital by secondary school enrolment and found that its motivate the engaging in science and technology that develop

the innovation. Aghion *et al.,* (2004) indicates to the education as a basic element for creating skilled labour where secondary education is a growth enhancing factor and those countries who invest more in education achieves a higher level of innovation. Also, Aghion and Howitt (1998) in there explanation about endogenous growth theory assure that enhancement of education is a major policy that have significant impact on the raising growth rate by raising incentive to innovate.

H_{04}: There is no statistical significant relationship between openness and innovation in the Arab World.

The result shows a positive and no statistical significant relationship between openness and innovation. Therefore, we accept the null hypothesis.

Openness is limited by some trade policies, cultures, productivity of the economy (Stensnes, 2006), and it could be influence by access to finance that reduce the barriers for international trade (Almeida and Fernandes, 2008). In the Arab World Countries openness suffer from complex policies, related to the Political unrest and wars, less developed and less access to finance . Those factor explain reason for the insignificant relationship with innovation that appeared in the analysis.

Our result is consistent with Falk (2005) who found that openness in lower developed OECD countries have less direct impact on domestic innovation ability.

Chapter 6

Conclusions and Recommendations

6-1 Introduction

This study aims to investigate the impact of banks development on innovation in the Arab World at macroeconomic level during the period (1963-2012). Based on the results of analyses the researcher reached a number of conclusions and recommendations which will be displayed below.

6-2 Conclusions of the Study

1-There is a positive relationship between banks development and innovation however its significant at 10% in the Arab World. Banks development consider very important factor in enhancing and increasing innovation in the Arab World. Its contribute in reduce the financial constraints and increase credit availability for firms that engage in innovative investment projects.

2-There is no relationship between economic growth and innovation in the Arab World, relative to the lower levels of GDP in most of its countries. Gross Domestic Product for some Arab World countries is less than the acceptable level which limit the availability of credit, countries

ability to innovate at macro-level, and reflect the non-development in their economies.

3-There is a positive statistical significant relationship between education level and innovation, where education is very important factor for enhancing innovation in the Arab World, it's create high skilled labor by increasing their knowledge and their productivity.

4-There is no relationship between openness trade and innovation, but it's not statistical significant in the Arab World, relative to the different factors that limit the international trade in its countries.

6-3 Recommendations

Based on our results we recommend that:

1-Banks should increase their role in financing the firms engaging in innovation investment project, where will be reflected on the ratios growth in economies.

2-Arab World should maintain on the levels of education in its countries focus building more stronger education infrastructure.

3-The openness trade and GDP in Arab World countries should be improved for their positive effect on innovation.

4- Future research is recommended in this area, for example you may add other variables that affect the innovation, and this research can be duplicated using panel data.

6-4 Limitation of the Study

During the process of preparing this study the researcher faced some problems such as:

1- Limited number of observations that's measured the innovation in Arab World.

2-The scarcity of studies on the effects of banks development on innovation in developing countries and on macroeconomic level, imposes a restriction in comparing the results of this study with similar studies in such countries.

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Appendix "1": Population of The Study

Number	Country Name
1	Jordan
2	Syrian Arab Republic
3	Saudi Arabia
4	United Arab Emirates
5	Oman
6	Morocco
7	Qatar
8	Lebanon
9	Yemen, Rep.
10	Bahrain
11	Algeria
12	Egypt, Arab Rep.
13	Iraq
14	Kuwait
15	Tunisia
16	Libya
17	Sudan
18	Mauretania
19	Djibouti
20	Somalia
21	Palestine
22	Islands

Appendix "2": The Sample of The Study

Number	Country Name
1	Jordan
2	Syrian Arab Republic
3	Saudi Arabia
4	United Arab Emirates
5	Oman
6	Morocco
7	Qatar
8	Lebanon
9	Yemen, Rep.
10	Bahrain
11	Algeria
12	Egypt, Arab Rep.
13	Iraq
14	Kuwait
15	Tunisia
16	Libya
17	Sudan
18	Djibouti
19	Somalia